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New records of flowering plants in Morelos state, Mexico

Rosa Cerros-Tlatilpa*, **Luis Gil Galván-González**, **Alejandro Flores-Morales**, **José Antonio Guerrero** and **Areli Rizo-Aguilar**

Universidad Autónoma del Estado de Morelos, Facultad de Ciencias Biológicas, Avenida Universidad 1001, Colonia Chamilpa, C.P. 62209, Cuernavaca, Morelos, Mexico
* Corresponding author. E-mail: tlatilpa@uaem.mx

Abstract: Nine new records of flowering plants are reported for Morelos state, Mexico. Most of the species occur at the Biological Corridor Chichinautzin and the Biosphere Reserve Sierra of Huautla, located at north and south of Morelos state, respectively. A brief diagnosis, phenology, notes and illustrations are included. These records are the outcome of floristic studies carried out by the authors in both natural reserves.

Key words: distribution extension, floristics, Neotropics, parasitic plants

The knowledge of the flora of the state of Morelos has been increasing with inventories at a diversity of scales including state (Rowell 1964; Vázquez 1974; Bonilla-Barbosa and Villaseñor 2003), region (Soria 1985; Cerros-Tlatilpa and Espejo-Serna 1998; Hernández-Cárdenas et al. 2014), municipality (Bárcenas 1977; Galindo and Fernández 2002), and nature reserves (Dorado et al. 2005; Pulido-Esparza et al. 2009; Flores-Castorena and Martínez-Alvarado 2010), plus focused taxonomical studies of specific flowering plant families (Espejo-Serna et al. 2002; Galván 2009; Gonzalez-Rocha and Cerros-Tlatilpa 2015; Miguel-Vázquez and Cerros-Tlatilpa 2013). In Mexico parasitic plants are poorly studied; for example, Alvarado-Cárdenas (2007) estimates 69 taxa of holoparasites in seven families and 11 genera. Likewise, there are some taxonomic treatments of hemiparasite families such as Santalaceae and Loranthaceae for some Mexican states but the numbers of families, genera and species for the country have not been estimated. For the state of Morelos parasitic plants include 11 families, 22 genera and 53 species (Galván 2009). A compilation of all these studies yields a list of 3138 species of flowering plants distributed in 173 families for the state of Morelos (Bonilla-Barbosa and Villaseñor 2003).

Between 2013 and 2014 floristic botanical explorations were undertaken throughout Morelos state (Figure 1), and plant specimens were collected from diverse ecological regions. The vouchers were dried, identified and deposited to the herbarium of Universidad Autónoma Metropolitana, Iztapalapa (UAMIZ). Duplicates were exchanged with Universidad Autónoma del Estado de Morelos (HUMO) and Universidad Nacional Autónoma de México (MEXU) herbaria. Taxonomic literature was reviewed for identification of genera and species of Ericaceae (Medina and Barrios 2005), Schoepfiaceae (Standley 1920), Loranthaceae (Kuijt 1975, 2009, 2011), Santalaceae (Kuijt 2003), and Scrophulariaceae (Standley and Williams 1973; Wetherwax 2012). Electronic resources such as Angiosperm Phylogeny Website (Stevens 2001), Tropicos of Missouri Botanical Garden, REMIB (World Biodiversity Information Network), Kew Herbarium Database, Global Plants Initiative, ePIC (electronic Plant Information Center 2002), and IPNI (The International Plant Names Index 2012) were consulted for all taxa examined.

Most taxa were easily-identified, except for the genus *Cladocolea* Tiegh., that shows close resemblance to *Struthanthus* Mart. (Loranthaceae) based on inflorescence features. All specimens were thoroughly examined and verified using types and compared with herbarium specimens at Universidad Nacional Autónoma de México (MEXU). Here we provide detailed descriptions, distribution information, phenological data and illustrations of the newly recorded species.

Ericaceae

Pterospora andromedea Nutt. (Nuttall 1818: 269–270). Figures 1 and 2.

Erect herb, reddish-brown to purple, 35 cm tall, viscid-pubescent. Leaf blades simple lanceolate, spirally arranged, 0.7–3.0 cm long, base attenuate, apex acuminated, sessile, papiraceus, margin ciliate. Inflorescence a terminal raceme, 5.5 cm long, pedicels 0.2–1.0 cm long, bracts 0.1–1.0 cm × 0.8–0.9 cm, margin

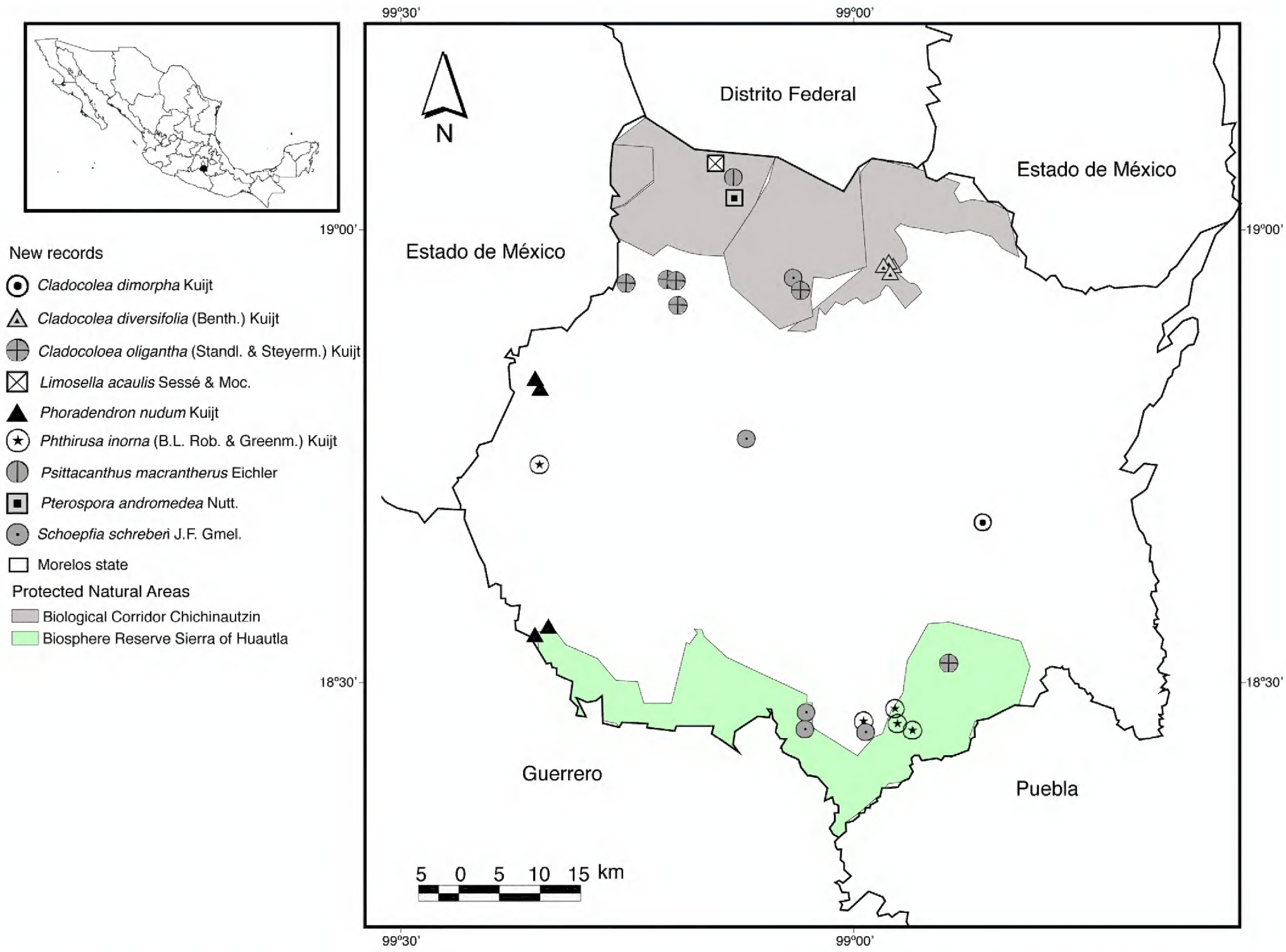

Figure 1. Map of Morelos state, Mexico, showing the Natural Protected Areas where new flowering plant records occur. Symbols indicate each species.

ciliate, irregular. Flowers not seen. Capsule globose, 0.5–0.9 cm × 0.6–0.9 mm; seeds 0.6–1.0 cm long with a membranous wing.

Flowering and fruiting period: July.

Remarks: Myco-heterotrophic plant that lacks chlorophyll and depends on mycorrihizal fungus for nutrients; grows in coniferous forest.

Distribution: USA (Arizona, California, Colorado, Idaho, South Dakota and Wyoming) and Mexico (Chihuahua, Coahuila, Distrito Federal, Durango, Michoacán, Mexico, Morelos, Nuevo León, Oaxaca, Puebla, Sonora, Tlaxcala and Veracruz).

Loranthaceae

Cladocolea dimorpha Kuijt (Kuijt 1975: 286–288). Figures 1 and 3.

Shrub erect, 20–45 cm high; stems glabrous, epicortical roots occasionally absent. Leaf blades simple, alternate, sessile, linear, 1.7–3.2 × 0.2–0.4 cm, base attenuate, apex acute, margin entire, glabrous. Inflorescence axillary, dimorphic, dichasium in inmature stems, or capitulum-like in mature stems, 3–5 flowers; scaly bract to foliose in the base and along of the peduncle, linear, 1.0–15.0 × 0.5–1.3 mm, glabrous, 4-merous, yellowish, hermaphroditic mature buds 3.8–1.4 mm long, anthers subsessile, monomorfic, 0.8–1.0 mm long, pistil sigmoid, 1.8–2.3 mm long. Berry subglobose, 4.2–5.3 mm in diameter. Seeds not seen.

Flowering and fruiting period: June–September.

Remarks: This is a noteworthy species because of its narrow and deciduous leaves (Kuijt 1975).

Distribution: Endemic to central Mexico, in tropical deciduous forest, at elevations up to 1,200 m. Previously known to occur in the states of Guerrero and Puebla, and now also in Morelos. Hosts: several species of Fabaceae such as *Lysiloma* Benth. and *Vachellia farnesiana* (L.) Wight & Arn.

Cladocolea diversifolia (Benth.) Kuijt (Bentham 1845: 63; Kuijt 1980: 519). Figures 1 and 4.

Shrub erect, dioecious, 60–80 cm high, stem glabrous with lenticels on older branches, epicortical roots present. Leaf blades simple, alternate, lanceolate to oblanceolate, 4.1–6.3 × 2.0–3.2 cm, base attenuated to cuneate, apex acute, margin entire, glabrous, subsessile

Figures 2–10. New records of flowering plants. **2.** *Pterospora andromedea* (Ericaceae), scale: 2 cm. **3.** *Cladocolea dimorpha* (Loranthaceae), scale: 1.5 cm. **4.** *Cladocolea diversifolia* (Loranthaceae), scale: 3 cm. **5.** *Cladocolea oligantha* (Loranthaceae), scale: 2 cm. **6.** *Phthirusa inorna* (Loranthaceae), scale: 8 mm. **7.** *Psittacanthus macrantherus* (Loranthaceae), scale: 3 cm. **8.** *Phoradendron nudum* (Santalaceae), inset: fruits, scale: 1 cm. **9.** *Shoepfia schreberi* (Shoepfiaceae), scale: 5 mm. **10.** *Limosella acaulis* (Scrophulariaceae), scale: 6 cm.

to petiolate, petiole 0.6–2.1 mm long. Inflorescence axillary in mature stems, male spikes-like with 4–7 flowers, female raceme with 3–6 monades; bract foliose in the base of the peduncle, ovate to obovate, 1.0–1.5 × 5.0–8.0 mm, glabrous. Flowers 6-merous, glabrous; male flowers green-yellowish, mature buds 5.7–8.8 mm long, anthers sessile to subsessile, dimorphic, 2.1–2.4 mm long, pistillode more or less straight 3.4–4.2 mm long; female flowers green-yellowish, mature buds 5.7–6.2 mm long, style spiral, 3.7–4.3 mm long, staminode filamentous. Berry oblong, 8.0–12 mm long, black. Seeds not seen.

Flowering and fruiting period: May–November.

Remarks: Occurs in oak forest, usually at elevations between 1700–2100 m. Hosts: Several species of *Quercus* L. (Fagaceae).

Distribution: Endemic to Mexico. Previously known to occur in the states of Guerrero, México, Michoacán and Puebla, and now also in Morelos.

Cladocolea oligantha (Standl. & Steyerm.) Kuijt (Standley and Steyermark 1944: 154; Kuijt 1975: 317). Figures 1 and 5.

Shrub erect, dioecious, 20–40 cm high; stem glabrous, smooth, striated when dry, epicortical roots absent. Leaf blades simple, alternate, simple, subsessile, lanceolate to oblanceolate, 2.0–4.5 × 0.8–1.8 cm, base attenuated, apex acute, obtuse to rounded, margin entire, glabrous. Inflorescences terminal and axillar, dimorphic, dichasium in immature stems, provided with a pair of scaly bracts, or capitulum-like in mature stems with 4–5 flowers, sessile, 4-merous, reddish-brown, glabrous, mature flower buds 3.9–4.3 mm long; male flowers with subsessile anthers, monomorphic, 1.4–1.8 mm long, pistillode straight, 3.2–3.7 mm long; female flowers with a geniculate style, 3.9–4.2 mm long, staminodes with vestigial anthers. Berry ovoid, ca. 6.2 mm long, black. Seeds not seen.

Flowering and fruiting period: May–November.

Remarks: Occurs in tropical deciduous forest, at elevations from 1480–1660 m. Hosts: *Bursera copallifera* (DC.) Bullock and *B. fagaroides* (Kunth) Engl. Relevant synonym (and basionym): *Struthanthus oliganthus* Standl. & Steyerm.

Distribution: Mexico to Central America. This is the species within the genus *Cladocolea* with the largest distribution range in Mexico (Kuijt 1975). Known to occur in the states of Chiapas, Guerrero, Oaxaca, Puebla and Zacatecas, and now also in Morelos.

Phthirusa inorna (B.L.Rob. & Greenm.) Kuijt (Robinson and Greenman 1895: 163; Kuijt 2011: 171). Figures 1 and 6.

Slender, profusely diffuse shrub, stems terete, smooth, striated when dry, epicortical roots absent from branches. Leaf blades simple, alternate, sessile to subsessile, lanceolate to narrowly oblanceolate, 1.2–3.6 × 0.2–0.6 cm, base attenuate, apex acute, margin entire, glabrous, deciduous. Flowers sessile to subsessile in leaf axils, hermaphroditic, reddish-brown, subtended by a pair of scaly lateral bracts, 0.8 mm long, fringed, deciduous; mature buds 2.6–3.1 mm long, petals monomorphic, anthers subsessile, 0.7–0.9 mm long, style straight, 1.3–1.7 mm long, deciduous, stigma capitate. Berry globose, 3.9–4.2 mm in diameter, black. Seeds not seen.

Flowering and fruiting period: May–November.

Remarks: A rare and inconspicuous plant in tropical deciduous forest, at elevations of 1,045–1,200 m. Hosts: Diverse species of legumes (Fabaceae).

Distribution: Endemic to Mexico. This species was known to occur in the states of Guerrero, Jalisco and Oaxaca, and now also in Morelos.

Psittacanthus macrantherus Eichler (Eichler 1868: 26). Figures 1 and 7.

Shrub pendant, 80–180 cm high; stems quadrangular when young, terete when mature. Leaf blade simple, opposite or subopposite, ovate to lanceolate, 9.0–15.0 × 4.0–6.0 cm, base obtuse, apex acute to rounded, margin entire, petiolate, petiole 3.5–6.8 mm long. Inflorescence a raceme with terminal triads, pedunculate, triad peduncle 0.8–1.3 cm long; scaly bracts 3.0–4.0 × 2.1–3.1 mm, acute; flowers hermaphroditic, pedicels 0.6–1.0 cm long; buds 6.0–6.6 cm long, straight; petals fleshy, yellowish orange becoming red with age; stamens dimorphic, filaments 1.7–1.9 cm long, anthers 1.3–1.6 cm long; style straight, 5.6–6.0 cm long. Berry ellipsoid, ca. 1.4 cm long, 7.0 mm in diameter, black.

Flowering and fruiting period: November–April.

Ecological notes: A unique plant within the genus that grows only in pine forest, at elevations up to 3,020 m. Hosts: Several species of *Pinus* L. (Pinaceae).

Distribution: Endemic to Central and Western Mexico (Kuijt 2009). Known to occur in the states of Durango, Guerrero, Jalisco, México, Michoacán Oaxaca and Sinaloa, and now also in Morelos.

Santalaceae

Phoradendron nudum Kuijt (Kuijt 2003: 323–324). Figures 1 and 8.

Shrubs pendent, dioecious, 40–80 cm long; stems terete, glabrous, dark green, turning yellow when dry; basal cataphylls absent. Leaf blades simple, decussate squamous, less than 1.0 mm long, obtuse, deciduous or persistent. Male spikes 1.0–1.5 cm long, fertile internodes 2.0–3.0, flowers 14–24 per bract, triseriate, glabrous; female spikes 6.0–9.0 mm long, fertile internodes 1–2, flowers 2–8 per bract, triseriate, glabrous. Berry globose, 3.2–3.6 mm in diameter, yellowish, glabrous. Seeds not seen.

Flowering and fruiting period: May–July.

Remarks: Few records are known for this species in Mexico, in tropical deciduous forest, at elevations of 987–1,530 m. Type species was described only with female inflorescences from a place named San Andrés, Morelos. This locality in fact belongs to San Andrés Nicolás Bravo, Estado de México. Hosts: *Ficus petiolaris* Kunth and other species of the genus (Moraceae).

Distribution: Endemic to central Mexico. The species was known to occur in the states of Guerrero, Jalisco and México (Kuijt 2003; Galván 2009), and now also in Morelos.

Schoepfiaceae

Schoepfia schreberi J.F.Gmel. (Gmelin 1791: 376). Figures 1 and 9.

Small trees or shrubs, 1.2–5.0 m tall; cork white-grayish, striated, young stems white, glabrous or with lenticelled. Leaf blades simple, alternate, ovate to lanceolate, glabrous, subsessile, 1.8–5.4 × 1.2–3.0 cm, base cuneate, apex acuminate. Inflorescence a cyme fasciculate, 2–4 flowers, peduncles papillate, 1.0–4.0 mm long; corolla gamopetalous, urceolate. 4–5 lobed, 3.6–4.0 mm long, red to yellowish, glabrous; lobes deltoid 1.2–3.3 mm long; stamens 4–5; filaments adnate to the corolla, anthers 1.0 mm long, style straight, 1.8 mm long, stigma capitate, ovary 1.1 mm long. Berry ellipsoid, 7.8–8.3 mm long, 5.4–6.2 mm diameter, reddish.

Flowering and fruiting period: December–March.

Remarks: Hemiparasitic plants obtain resources from the xylem tissue that transports water and inorganic nutrients. The host provides water and minerals but they have chlorophyll and partially synthesize the necessary nutritional elements. This species is common in tropical deciduous forest, at elevations of 1,015–1,480 m.

Distribution: From Florida, USA to northern South America. In Mexico previously known to occur in the states of Chiapas, Guanajuato, Guerrero, México, Michoacán, Nayarit, Oaxaca, Puebla, Querétaro, San Luis Potosí, Sinaloa, Sonora, Tabasco, Tamaulipas, Veracruz and Yucatán (Calderón de Rzedowski 1995), and now also in Morelos.

Scrophulariaceae

Limosella acaulis Sessé & Moc. (Sessé y Lacasta and Mociño 1894: 143). Figures 1 and 10.

Annual herb, acaulescent, stoloniferous, 1.5–3.5 cm high. Leaf blades simple, sessile, rosseted, spatulated, 10.0–24.3 mm long, dilated above, 0.4–1.0 mm wide, base truncate, apex obtuse, margin entire. Flowers white, hermaphrodite, solitary, 2.2–3.7 mm long; pedicels slender, 5.2 mm long, calyx fused at the base, campanulate, corolla 5-merous, lobules acute to round; stamens exerted, anthers purple 0.3 mm long, filaments glabrous 0. 8 mm long; ovary slightly globose, 0.4 mm. Capsule globose, 2.3 mm long. Seeds not seen.

Flowering and fruiting period: November.

Remarks: This species grows at the margins of temporary pools in pine forest.

Distribution: USA (California) and Mexico. In Mexico this species was known to occur in the states of Aguascalientes, Baja California, Baja California Sur, Chiapas, Coahuila, Distrito Federal, Guanajuato, Querétaro, Hidalgo, Jalisco, Michoacán, México, Oaxaca, Puebla, Tlaxcala and Veracruz (Pérez-Calix 2011), and now also in Morelos.

Nine species from seven genera and five families of flowering plants are recorded for first time in Morelos state, Mexico. Seven taxa are parasitic plants (Vidal-Russell and Nickrent 2008), all are aerial except for *Schoepfia schreberi* which is a root parasite (Werth and Baird 1979); five of these species are in the Loranthaceae family, whereas the Santalaceae and Schoepfiaceae have one species each. *Cladocolea dimorpha, C. oligantha, Phthirusa inorna, Phoradendron nudum* and *Schoepfia schreberi* occur in tropical deciduous forest; *Cladocolea diversifolia* and *Psittacanthus macrantherus* grow only in oak forest and pine forest, respectively. Most of these species are considered stem specialized parasites with potential to attack many host plant species. This generalist strategy in Loranthaceae allows parasitizing different genera such as *Lysiloma* spp., *Vachellia* spp., *Bursera* spp., *Quercus* spp. and *Pinus* spp. whereas species such as *Ficus petiolaris* are the only host for *Phoradendron nudum*. Parasitic plants with one or a few hosts are the exceptions. On the other hand, *Schoepfia schereberi* lacks specificity according to Werth and Baird (1979). Furthermore, this work includes non-parasites such as *Limosella acaulis* and *Pterospora andromedea*, the latter a mycohetrotrophic plant (Bakshi 1959), which inhabit coniferous forests.

Of all these new records only *Cladocolea dimorpha*, *C. diversifolia*, *Phthirusa inorna* and *Psittacanthus macrantherus* are endemic species to Mexico; their distribution has now expanded to include the state of Morelos (Kuijt 1975, 2009, 2011).

The natural protected areas play an important role because they contribute to reducing biodiversity loss. The Biological Corridor Chichinautzin supports at least four of these new records and the Biosphere Reserve Sierra of Huautla includes two species. However, these species were observed also in other localities of Morelos (Figure 1).

Material Examined

Pterospora andromedea — Mexico. Morelos: Huitzilac: 2.2 km NE of bridge Paso Morelos, 29 September 2014, *Hernández-Cárdenas 752b* (HUMO 27227).

Cladocolea dimorpha — Mexico. Morelos: Ayala:

Huitzililla, edge of the road, 11 August 2013, *Galván 5* (UAMIZ 78562, UAMIZ 78563).

Cladocolea diversifolia — Mexico. Morelos: Tlayacapan: Cerro Las Mariposas, surroundings of San José de los Laureles Village, 20 September 1994, *Cerros 272* (UAMIZ 77425); Cerro Las Mariposas, surroundings of San José de los Laureles Village, 30 September 1994, *Cerros 336a,* (UAMIZ 77450); Cerro Las Mariposas, surroundings of San José de los Laureles Village, 30 September 1994, *Cerros 337,* (UAMIZ 77425); towards the top of hill Las Mariposas, 19 November 2014, *Galván 147* (UAMIZ 78558).

Cladocolea oligantha — Mexico. Morelos: Cuernavaca: Waste ground on Avenue Ahuatlán, Lomas de Ahuatlán, 2 November 2014, *Flores 100* (UAMIZ 68385); El Salto, 28 May 1972, *Vázquez 3627* (MEXU 169892); Lomas de Ahuatlán, 18 August 2013, *Cerros 2523* (UAMIZ 78559); Lomas de Ahuatlán, crossing the gully towards Lomas de Zompantle, 19 September 2013, *Galván 36* (HUMO 78560). Tepalcingo: 1 km SE to El Limón, 11 August 2013, *Galván 2* (UAMIZ 78557). Tepoztlán: San Andrés de la Cal, towards the top of Cerro de la Cal, 15 September 2013, *Galván 32* (UAMIZ 78561).

Phthirusa inorna — Mexico. Morelos: Coatlán del Rio: roadside of Cocoyotla-San Andrés Nicolás Bravo, near boundary with Estado de México, 1 May 2014, *Galván 108* (UAMIZ 68397, UAMIZ 68398). Tlaquiltenango: Huautla, 3 km NE of Cruz Pintada, 6 February 2014, *Galván 87, 88* (UAMIZ 68394, UAMIZ 68395, UAMIZ 68396); Facing the dam Lorenzo Vázquez, 24 February 2014, *Cerros 2763, 2764* (UAMIZ 68482, UAMIZ 68483, UAMIZ 68485, UAMIZ 68487).

Psittacanthus macrantherus — Mexico. Morelos: Huitzilac: 3 km NE of the gas station Tres Marías, 2 March 2014, *Galván 93* (UAMIZ 68532, UAMIZ 68533).

Phoradendron nudum — Mexico. Morelos: Amacuzac: Edge of the road Cocoyotla-San Andrés Nicolás Bravo, near boundary with Estado de México, 1 May 2014, *Galván 106* (UAMIZ 68350, UAMIZ 68351); km marker 18, toll road to Acapulco, at 2 km of Cazahuatlán, 100 m edge to the road, 3 July 2014, *Galván 120* (UAMIZ 68349). Miacatlán: Edge of Palo Grande, 14 June 2014, *Galván 116* (UAMIZ 68348); Palo Grande, on road to Miacatlan-Palpan de Barranda, 14 June 2014, *Galván 117* (UAMIZ 68341).

Schoepfia schreberi — Mexico. Morelos: Emiliano Zapata: Tetecalita, 0.5 km from the farm "La Ponderosa", up the street Prolongación Cumbres, 12 December 2013, *Galván 66* (UAMIZ 71267, UAMIZ 71268). Tepoztlán: 2 km NE of San Andres de la Cal, 9 March 2014, *Galván 103* (HUMO 27813). Tlaquiltenango: 2 km N of Cruz Pintada, 6 January 2014, *Galván 83* (UAMIZ 71270); Face of the dam Lorenzo Vázquez, 24 February 2014, *Cerros 2762* (UAMIZ 71232, UAMIZ 71233); 1 km SW of Xochipala, 3 February 1996, *Martínez 19* (HUMO 13116).

Limosella acaulis — Mexico. Morelos: Huitzilac: 4.16 km NE from the bridge Paso Morelos, 20 November 2014, *Hernández–Barón 128* (HUMO 28386).

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